

MAIL PIECE VERIFICATION SYSTEM**Field of the Invention**

This invention relates to mail piece verification systems. More particularly, this invention is directed to a mail piece verification system
5 conducting successive verification activities on a mail piece along different stages of a mail processing system.

Background of the Invention

Generally, postage metering systems are well known in the art. Typically, the traditional mechanical and electronic postage meters have
10 employed physical security and specialized inks to prevent fraud. The registers that maintain an accounting of postal funds have been located within a secure housing along with a dedicated printer. As a further measure, the dedicated printers have used fluorescent ink to provide an extra aid in the detection of an authentic postage meter indicium.

15 More recently, postal authorities have promulgated regulations that allow postage meter manufacturers to utilized digital printing technology (laser, ink jet, thermal transfer, etc.), either embedded as part of a mail handling system or as a general purpose office printer. As an example, the United States Postal Service (USPS) has enabled the decoupling of the
20 postage meter and the printer and allowed the use of digital printers by establishing an Information-Based Indicia Program (IBIP). The IBIP is a distributed trusted system established by the USPS to retrofit and augment existing postage meters using new technology known as information-based indicia. The IBIP relies on digital signature techniques to produce for each
25 mail piece an indicium whose origin cannot be repudiated. Thus, in contrast to traditional postage metering systems employing mechanical printing technology and physical security, the IBIP supports new methods of securely applying postage to mail pieces. Generally, the IBIP requires printing a high-density two-dimensional (2D) bar code on a mail piece. The 2D barcode

encodes various information associated with the mail piece and is subsequently signed with a digital signature.

The USPS has published detailed specifications for the IBIP.

Generally, the IBIP is directed to two types of postage metering systems. The

- 5 first type is referred to as a closed system and is defined in the INFORMATION BASED INDICIA PROGRAM - PERFORMANCE CRITERIA FOR INFORMATION-BASED INDICIA AND SECURITY ARCHITECTURE FOR CLOSED IBI POSTAGE METERINGS SYSTEMS, dated January 12, 1999, ("IBIP Closed System Specification"). The second type is referred to as
- 10 an open system and is defined in the INFORMATION BASED INDICIA PROGRAM - PERFORMANCE CRITERIA FOR INFORMATION-BASED INDICIA AND SECURITY ARCHITECTURE FOR OPEN IBI POSTAGE EVIDENCING SYSTEMS, dated February 23, 2000, ("IBIP Open System Specification"). Together, the IBIP Closed System Specification and the IBIP
- 15 Open System Specification define the requirements for next generation postage metering systems.

- Although the transition to digital printing provides many advantages, the postal authorities recognize that digital printing spawns potential new forms of fraud. As an example, an individual seeking to commit a fraud upon
- 20 the postal authority need only utilize their computer, image scanner and printer to generate multiple copies of a single postal indicium. Thus, a valid indicium may be replicated perfectly. This technique is referred to as fraud by duplication.

- As a result, measures have been developed to detect such attempts to
- 25 defraud the postal authorities. Typically, these measures involve verifying the authenticity of the postal indicium on a mail piece as the mail piece is being processed by the postal authority. This verification activity seeks to ensure that the postage amount shown in the postal indicium has been properly accounted for. For instance, the postal authority may validate the digital
- 30 signature discussed above to determine the authenticity of the postal indicium. However, this will not necessarily expose a second mail piece with a duplicated postal indicium representing an exact copy of a valid indicium.

Thus, detection of these types of duplicates, and other issues, present problems for the postal authorities.

Another problem faced by the postal authorities is the intensive data processing required of a distributed mail processing system employing a plurality of remotely located processing centers. Typically, the processing center must scan each postal indicium to obtain its data, conduct database lookups, perform cryptographic calculations and determine whether or not the postal indicium is valid. If a mail piece cannot be validated, it is diverted to an out sort bin for further investigation and/or return to the sender. Complicating this situation is the fact that such verification processing is conducted by a single mail piece processing system. This necessitates that the verification processing is completed during the interval between mail piece scanning and the diversion location to the out sort bin. Given the rate at which the processing machines operate (up to 12 mail pieces per second), there is very little time to perform verification checks.

Still further complications exist. If the cryptographic computations are to be performed locally (on individual processing machines), then large amounts of data must be distributed to all of the processing machines (e.g. cryptographic keys for each postage meter, data to enable detection of duplicate indicia) and kept updated to reflect changes in the meter population. On the other hand, if the computations are performed remotely, then the postal indicium data for each mail piece must be transmitted in real time to a central location, validated and the results returned to the processing machine before the mail piece reaches the diversion point. Both of these arrangements require significant real time processing and rapid database access.

Therefore, there is a need for a mail piece verification system that provides operational advantages over those described above. Furthermore, there is a need for a mail piece verification system that reduces the data processing requirements of the overall system while maintaining or improving upon its integrity.

Summary of the Invention

Accordingly, it is an object of the present invention to provide a mail piece verification system that addresses the drawbacks and disadvantage of the prior art systems.

5 In accomplishing these and other objects there is provided a mail piece verification system for processing a mail piece having associated therewith mail piece data includes an incoming mail processing center, an outgoing mail processing center located downstream from the incoming mail processing center and a data center in operative communication with the
10 incoming mail processing center and the outgoing mail processing center. The incoming mail processing center receives the mail piece, obtains the mail piece and uploads the mail piece data to the data center. The data center performs a verification check on the mail piece data and downloads instructions based upon the verification check to the outgoing mail processing
15 center. The outgoing mail processing center uses the instructions to process the mail piece.

Additionally, there are provided a method of operating the mail piece verification system and a method of operating a data center for processing mail piece data, respectively, that are generally analogous to the summary
20 provided above.

Therefore, it should now be apparent that the invention substantially achieves all the above objects and advantages. Additional objects and advantages of the invention will be set forth in the description which follows, and in part will be obvious from the description, or may be learned by practice
25 of the invention. Moreover, the objects and advantages of the invention may be realized and obtained by means of the instrumentalities and combinations particularly pointed out in the appended claims.

Brief Description of the Drawings

The accompanying drawings, which are incorporated in and constitute
30 a part of the specification, illustrate presently preferred embodiments of the invention, and together with the general description given above and the

detailed description of the preferred embodiments given below, serve to explain the principles of the invention. As shown throughout the drawings, like reference numerals designate like or corresponding parts.

Fig. 1 is a schematic representation of a mail piece verification system
5 in accordance with the present invention.

Fig. 2 is an example of a postal indicium printed by a postage metering system that is processed by the mail piece verification system in accordance with the present invention.

Fig. 3 is an example of a prior art mail piece that may be verified by the
10 verification system in accordance with the present invention.

Fig. 4 is a flow chart depicting the operation of the mail piece verification system in accordance with the present invention.

Detailed Description of the Preferred Embodiments

Referring to Fig. 1, a schematic representation a mail piece verification
15 system 100 for processing a mail piece 20 (envelope, post card, package, label, e-mail, or the like), having a postal indicium 30 printed thereon (or attached to, embedded in or otherwise associated with electronic forms of the mail piece 20), in a path of travel as indicated by the solid arrows is shown. The mail piece verification system 100 includes a deposit location 110, an
20 incoming mail processing center 120 having an incoming out sort bin 122, a central postal data center 130, a transportation system 140, an outgoing mail processing center 150 having an outgoing out sort bin 152 and a delivery location 160. The central postal data center 130 is in operative communication with the incoming mail processing center 120 and the
25 outgoing mail processing center 150 over any suitable conventional communication network, such as: telephone lines, a local area network, a wide area network, the Internet or the like. Generally, as shown in Fig. 1, the solid lines with arrows are intended to represent the flow of the mail piece 20 while the dashed lines with arrows are intended to represent data flow, as
30 described in greater detail below.

For the sake of clarity, the mail piece verification system 100 has been shown with respect to a particular mail piece 20. Those skilled in the art will recognize that the mail piece verification system 100 may employ a plurality of deposit locations 110 that receive mail pieces 20 and direct them to a plurality of incoming mail processing centers 120. From these centers 120, the mail pieces 20 are transported over a plurality of transportation systems 140 to a plurality of outgoing mail processing centers 150 so that the mail pieces may be delivered to a plurality of delivery locations 160, accordingly. Thus, the mail piece verification system 100 represents a network of systems that connect the deposit locations 110 to the delivery locations 160. Each mail piece 20 is routed through the mail piece verification system 100 (network) according to numerous factors, such as: the class of service selected and the physical locations of the deposit 110 and the delivery location 160.

The deposit location 110 may be any acceptance point (post office window, mail box, computer server, etc.) that the postal authority has designated for receiving mail pieces 20 from the public. The incoming mail processing center 120 may or may not be co-located with the deposit location 110. In either case, the mail pieces 20 are directed by postal authority to the incoming mail processing center 120 which may employ one or more mail processing machines, such as the Small Parcel and Bundle Sorter, the Advanced Facer Cancellor System or the Flats Sorting Machine, all available from Lockheed Martin - Postal Automation Systems. These mail processing machines typically perform preliminary tasks on the mail pieces 20, such as: culling, positioning (facing the mail piece), POSTNET bar code printing, sorting and the like. Any mail pieces 20 that are deemed unacceptable are diverted to the out sort bin 122. Once the preliminary mail processing tasks are completed, the mail piece 20 travels over the transportation system 140 to the outgoing mail processing center 150. The transportation system 140 may employ any suitable combination of physical transport, such as: truck, plane, boat, car, computer network, or the like. The outgoing mail processing center 150 is very similar to the incoming mail processing center 120 and may

employ one or more of the same types of mail processing machines described above. These mail processing machines typically perform secondary tasks on the mail pieces 20, such as: culling, positioning, POSTNET bar code reading, sorting and the like. Any mail pieces 20 that are

5 deemed unacceptable are diverted to the out sort bin 152. Once the secondary mail processing tasks are completed, the mail piece 20 is routed via a designated post office to the delivery location 160 (home address, business address, post office box, computer account, IP address or the like).

Those skilled in the art will recognize that any combination of incoming

10 mail processing centers 120, transportation systems 140 and outgoing mail processing centers 15 may be employed to effect receipt of the mail piece 20 at the deposit location 110 and route the mail piece 20 to the delivery location 160. For example, many intermediate processing centers may be employed and the transportation system 140 may be deployed in stages. Numerous

15 factors, such as the class of service and the physical proximity of the deposit location 110 to the delivery location 160, may influence the exact route that a particular mail piece 20 may take while it is in transit.

Furthermore, those skilled in the art will appreciate that the incoming mail processing center 120 and the outgoing mail processing center 150 may

20 be co-located. In fact, they may actually be the same mail processing center. In some ways what differentiates the incoming mail processing center 120 from the outgoing mail processing center 150 is the status of the mail piece 20. If the mail piece 20 has just been received, then the mail processing center is operating as the incoming mail processing center 120. On the other

25 hand, if the mail piece 20 is well along its delivery route, then the mail processing center is operating as the outgoing mail processing center 150. Thus, at any given location, the same mail processing center may be operating as both an incoming mail processing center 120 (for the mail pieces 20 that have just been deposited for delivery) and as an outgoing mail

30 processing center 150 (for the mail pieces 20 that have already been processed and are nearing their delivery points).

Still further, instead of being a singular facility, the postal data center 130 may be embodied as a plurality of regional postal data centers 130 that are geographically dispersed and networked together using suitable communication techniques. This may allow for various advantages, such as:

5 system redundancy (in case of failures), quicker response times and reduced communication expenses, while preserving the benefits of the communication path ways generally described above and in more detail below.

Referring to Fig. 2 in view of Fig. 1, a more detailed view of the postal indicium 30 is shown. Since the postal indicium 30 does not constitute a part

10 of the present invention, the following description is being provided with respect to a particular type of postal indicium 30 by way of background. Generally, the postal indicium 30 includes both fixed data that does not change from indicium to indicium and variable data that may change. The fixed and variable data may change depending upon postal authority

15 requirements and the needs of the postage system manufacturer, but generally can be summarized as follows. The fixed data includes a graphic design 31 (an eagle with stars and US POSTAGE), a meter serial number 32 uniquely identifying the postage meter (not shown) that produced the postal indicium 30, a licensing post office ID (Zip Code) 33 and an optional facer

20 identification mark (FIM) 34 used during post office processing. The variable data includes a date 35 indicating when the postage was dispensed, a postal value 36 indicating an amount of postage, an indication of a service class (first class, bulk rate, priority, overnight, certified, etc.) that has been selected for the mail piece 20, a bar code 37 containing both elements of both fixed

25 and variable data and, in the most preferred embodiment, authentication information 38. The bar code 37 may be of any conventional format and is provided for the purpose of improving machine readability and increasing automated processing of the mail piece 20. Generally, the authentication information 38 is an encrypted message, such as a digital signature, digital

30 token or other data, derived from the information contained with the postal indicium 30. The authentication information 38 may be in any format, such as: alphanumeric string, bar code or the like. Most preferably, the

authentication information 38 is incorporated into the bar code 37. Using the authentication information 38 and other data contained within the postal indicium 30, the postal authority can verify the authenticity of the postal indicium 30 using conventional techniques. Thus, the postal indicium 30 may also be classified as containing authentication information 38 and non-authentication information 31-37 and 39.

As mentioned above, the postal indicium 30 need only be associated with the particular mail piece 20. Therefore, when the mail piece 20 takes electronic form, the postal indicium 30 may be reconfigured accordingly.

Referring to Fig. 3, in view of Figs. 1 and 2, an example of a prior art mail piece 20 that may be processed by the verification system 100 is shown. The mail piece 20 includes the postal indicium 30 (as described above), a sender address 40 (optional) and a recipient address 50. The recipient address 50 provides information to the postal authority corresponding to the delivery location 160. The typical recipient address 50 includes a recipient name 52 (personal, business or generic (occupant)), recipient delivery information 54 (street address, post office box number, etc.), a city name 56, a state name 57 and a ZIP code 58.

With the structure of the present invention described as above, the operational characteristics will now be described with respect to receipt and delivery of the mail piece 20. For the sake of clarity, it is assumed that the mail piece 20 is processed by only one incoming mail processing center 120 and only one outgoing mail processing center 150. Referring primarily to Fig. 4 while referencing the structure of Figs. 1, 2 and 3, a flow chart 400 of the operation of the mail piece verification system 100 in accordance with the present invention is shown.

After receiving the mail piece 20 at the deposit location 110, at 402, the mail piece 20 is scanned at the incoming mail processing center 120 to obtain mail piece data. The mail piece data may include the postal indicium 30, the recipient address 50, the sender address 40 or any combination or subset of the above. Next, at 404, a determination may optionally be made whether or not the mail piece 20 meets preliminary conditions. In the most preferred

embodiment, the preliminary conditions do not involve cryptographic calculations or access to complicated databases. The preliminary conditions may include: recognition of a valid meter serial number 32, a posting date 35 within an acceptable range of the current date, suitable readability of the mail piece 20 in terms of accuracy and completeness and recognition of a valid recipient address 50. If at 404 the answer is no, then at 406 the mail piece 20 is out sorted to out sort bin 122 for further investigation, human reading, return to the sender or some other suitable action. On the other hand, if the answer at 404 is yes, then at 408 a global identification number (preferably an alphanumeric string) (not shown) is assigned to the mail piece 20 that uniquely identifies the mail piece 20 to the postal authority. The global identification number may preferably be chosen to reflect other information, such as: the particular incoming mail processing center 110 that received the mail piece 20. Optionally, the global identification number may be printed on the mail piece 20 in bar code or some other conventional format. Generally, the global identification numbers are allocated to the incoming mail processing center 120 by the central postal data center 130. In this way, the incoming mail processing center 120 may assign the numbers one at a time as the mail pieces 20 are received. Next, at 410, the mail piece data and the global identification number are uploaded from the incoming mail processing center 120 to the central postal data center 130. Next, at 412, the mail piece 20 is advanced downstream in the path of travel along the delivery route by the transportation system 140. Next, at 414, the central postal data center 130 conducts an analysis to see if the mail piece 20 meets secondary conditions. In the most preferred embodiment, the secondary conditions involve cryptographic calculations to determine the validity of the postal indicium 30. Those skilled in the art will recognize that the mail piece data may be transmitted to a central postal data center 130 for verification either immediately or as a batch process at some later time. Since the incoming mail processing center 120 does not perform cryptographic verification checks, there is no need to distribute sensitive information (e.g., cryptographic keys, "license plates," duplicate data and the like) to the

incoming mail processing center 120. In addition, the computational requirements for the incoming mail processing center 120 are significantly reduced (no need to rapidly perform database lookups or cryptographic operations).

5 Next, at 416, the central postal data center 130 downloads instructions, as necessary, to the outgoing mail processing center 150 for use in processing the mail piece 20. In the most preferred embodiment, the processing instructions are associated with the global identification number of the mail piece 20. For example, the instruction may indicate that the mail
10 piece 20 should be diverted to the out sort bin 152 for follow up by a postal authority investigator. As another example, the instructions may indicate that the mail piece 20 should be processed in a normal fashion. In the alternative, instructions may only be supplied for "special" (other than normal) processing. In this situation, the absence of a special instruction (divert instruction) may
15 indicate that the outgoing mail processing center 150 should process the mail piece 20 in a normal fashion. Next, at 418, the outgoing mail processing center 150 scans the mail piece 20 to obtain the global identification number. As discussed above, it may have even been printed on the mail piece 20 by the incoming mail processing center 120. Next, at 420, the outgoing mail
20 processing center 150 retrieves any processing instructions associated with the global identification number through simple database access. Next, at 422, the outgoing mail processing center 150 processes the mail piece 20 in accordance with the processing instructions, as described above.

Those skilled in the art will now recognize that the present invention
25 substantially addresses many of the drawbacks and deficiencies associated with conventional mail processing in addition to those discussed above. Since all cryptographic verification operations (indicium verification, duplicate detection) are performed at the central postal data center 130, the overall security and integrity of the system 100 are improved but access to the
30 cryptographic information is limited. Since the cryptographic verification operations are generally performed while the mail piece 20 is in transit from the incoming mail processing center 120 to the outgoing mail processing

center 150, this significantly increases the time allotted to perform verification. This extra time enables more detailed checks to be performed. Furthermore, by migrating cryptographic verification operations to the central postal data center 130, the verification procedures may be more easily modified on an as
5 needed basis (the current system would require major distributed system updates to be performed in order to change verification procedures).

When the mail piece 20 is scanned at the incoming mail processing center 120, the delivery route through the system 100 to the delivery location 160 is often determined using the ZIP code 33 in view of existing
10 transportation hubs and the proximity of the delivery location 160 to available outgoing mail processing centers 150. Therefore, even further efficiencies may be available. For example, the need to broadcast the down load of the processing instruction to the entire population of outgoing mail processing centers 150 may be eliminated. Instead, the processing instructions may be
15 directly sent to a particular one of the outgoing mail processing centers 150 corresponding to the determined delivery route of the mail piece. In this manner, the amount of data that is download and the total communications between the central postal data center 130 and the population of outgoing mail processing centers 150 is reduced.

20 As a further benefit, the system 100 of the present invention also increases the chance that a pair of duplicate mail pieces 20 can be captured for investigation and/or prosecution. In the current system, a duplicate mail piece 20 can only be detected after the "original" has been processed. Therefore, the current system is not set up to out sort both an original mail
25 piece 20 and a fraudulent copy. Without both mail pieces 20, prosecution of the offender is likely to be much harder. Since the present invention performs duplicate checking while the mail pieces 20 are in transit and provides the opportunity for downstream diversion, both the original and the duplicate may be captured. In other words, if a duplicate enters the mail stream prior to
30 delivery of the original mail piece 20, then both mail pieces 20 can be out sorted for investigation.

As yet another benefit, the service class 39 information may be used to determine a priority for scheduling: (i) the uploading of the mail piece data; (ii) the performance of the secondary checks; and/or (iii) the downloading of the processing instructions. As examples, in this manner, the different data handling needs of a mail piece 20 that has been sent by overnight delivery may be expedited, those of a 1st class mail piece 20 may be somewhat more moderately attended to while those of a bulk rate mail piece 20 may be addressed in an even more deliberate manner. Thus, the postal authority may more efficiently process the mail piece data based on the service class 39 in view of the amount of delivery time available, the anticipated likelihood of fraud (large volume mailings, such as bulk rate, often are targeted by fraudulent actors than lower volume mailings, such as priority mail) and other factors. As a result, the incoming mail processing center 120 may communicate more frequently with the central postal data center 130 for the purpose of uploading mail piece data associated with short delivery cycles while those of mail pieces 20 having longer delivery cycles may occur during "off peak" periods. Thus, the service class 39 may be used to set a priority for the upload of mail piece data and in analogous fashion the subsequent download of processing instructions.

Those skilled in the art will recognize that various modifications can be made without departing from the spirit of the present invention. For example, a series of central postal data centers 130 in communication with each other could be set up to share and distribute verification tasks. As another example, letter carriers or mail boxes could perform scanning of the postal indicium 30 at time of deposit. This would accelerate the input of the mail piece data into the system 100. As yet another example, a list of valid mail pieces 20 could be transmitted to the outgoing mail processing centers to ensure that fraudulent mail pieces were not introduced into the mail stream during transport due to corrupt postal authority employees or otherwise.

Thus, the central postal data center 130 could download a list of valid global identification numbers. In the absence of the scanned global identification number appearing on such a list, the mail piece 20 could be diverted. As yet

still another example, those skilled in the art will recognize that many of the steps and activities described above may be performed in differing orders or concurrently. As still yet another example, if the mail piece 20 is an electronic file, then the postal indicium 30 may be replaced with any other suitable

- 5 indication of payment and instead of scanning the mail piece 20, the mail piece data may already be associated with the mail piece 20 such as by attachment as a header file. As still yet another example, the verification system 100 has been described with respect to an unrestricted access system where anyone may utilize the mail piece delivery network. However,
- 10 those skilled in the art will recognize that the verification system 100 would work equally as well in a restricted access system (such as: subscription based delivery services and the like) where delivery services would only be provided for selected individuals and/or organizations.

- Therefore, the inventive concept in its broader aspects is not limited to
- 15 the specific details of the preferred embodiments but is defined by the appended claims and their equivalents.